FIGS. 5–6 illustrate another preferred embodiment of an intraocular lens implant of this invention wherein like reference numerals denote like elements of structure to those illustrated in FIGS. 1–4. As shown in FIGS. 5-6, a premolded disk 70 is provided having a circular cavity or depression 72 formed centrally therein. This central cavity 72 is inset into the surface of the disk 70 to a depth which is slightly less than the total thickness of the disk 70 so that a thin, optically clear membrane 74 is formed centrally in the remaining surface of the disk 70 opposite the open side of the cavity 72. A separate thin, optically clear circular sheet or membrane 76 is bonded, glued or otherwise affixed in sealing engagement over the open side of the cavity 72 by attaching a circumferential edge 78 of the membrane 76 to a rim section 80 circumferentially surrounding the cavity 72 in the premolded disk 70.

Once the membrane 76 is attached to the disk 70 in sealing engagement, the assembly 10 is completed with the central lens 12 being formed in the disk 70 by the cavity 72 enclosed by the membranes 74 and 76 and the ring structure 14 including outer ring 44 and web member 50 which interconnects the lens 12 and the outer ring 44 being provided by the surrounding portion of the disk 70 concentric to the circular central cavity 72. As best illustrated in FIG. 5, the ring structure 14 in this embodiment is in a multi-lobe configuration although shape and arrangement of this structure is a matter of choice.

The disk 70 with the membrane 74 formed integrally therewith can be fabricated from any suitable elastomeric material such as a silicone rubber and the method of formation can be by casting or spin casting with a mold which can be fashioned to create various thicknesses throughout the surface of the disk 72 or in order to achieve special shapes and/or cut-outs therein. For example, as best illustrated in FIGS. 5, it can be seen that the ring structure 14 in disk 70 in the depicted embodiment includes cut-outs 82 which are formed in the section of the disk 70 corresponding to the web member 50 so that the cut-outs 82 are interspersed between strips of webbing 84 which are employed to operatively interconnect the outer ring 44 with the central lens 12. Optionally, the initial molded disk 70 may not include these cut-outs 82 and, if desired, they may be formed later in the disk 70 by employing an additional cutting step. The details of the pattern of the cut-outs 82, if any, utilized in the assemblies 10 depend on various factors such as the elasticity of the material forming the disk 70 and the thickness of the various functional regions of the assembly 10.

Thin circular membrane 76 which is bonded to the open side of the central cavity 72 of disk 70 to form the enclosure for central lens 12 may be formed by casting or spin casting a fluid which can be cured to produce an elastomeric material such as silicone rubber. The enclosed central lens 12 may be inflated into fully expanded condition by the injection of a suitable material such as a viscous fluid or a fluid composition which is a gel or cures with a gel-like or elastomeric consistency into the cavity 72. Introduction of the injectible material into the lens 12 may be accomplished employing any suitable technique such as by injecting the material through canulae formed in the surface of either membrane 74 or 76. Additionally, if desired, the injectible material may be introduced into cavity 72 by injecting the material with a hypodermic needle through the membrane 74 or 76.

The assembly 10 illustrated in FIGS. 5–6 operates in a similar manner to the embodiment of this invention illustrated in FIGS. 1–4. That is, after implantation, the outer ring member 44 of the ring structure 14 is positioned in operative engagement with the ciliary muscle of the eye. The outer ring 44 transmits radial tension to the central lens 12 via the strips 84 which comprise the web member 50 in order to stretch the lens 12 radially outwardly and, upon contraction of the muscle, the outer ring 44 is compressed so that the radial tension transmitted from the outer ring 44 to the lens 12 via the web 50 is relaxed enabling the central lens 12 to essentially uniformly deform about its circumference and to alter its curvature.

In a further preferred embodiment of this invention, the lens 12 as well as the ring structure 14 is pre-molded rather than being expanded or inflated by injection of injectible material therein. For example, such an assembly can be produced by molding a disk 70 with a central circular hole concentrically positioned within a ring structure 14. A lens 12 is molded as a separate circular member of soft, elastomeric material with an outer circumference less than the diameter of the hole in the disk 70. The integral lens 12 then is positioned inside the hole in the disk 70 and the ring structure 14 of the disk 70 is compressed to match the outer circumference of the lens 12 and the outer circumference of the lens 12 is affixed to the inner circumference of the ring structure 14. After attachment is completed and the assembly 10 is allowed to assume its natural state, the ring structure 14 stretches the central lens 12 to a large diameter having a lens curvature different than the curvature of the lens 12 as originally molded in view of the tension applied thereto by the ring structure 14. Upon relaxation of this tension, the assembly 10 operates to achieve an alternate lens curvature as detailed above.

While specific embodiments of this invention have been shown and described herein, it will be clear to those skilled in the art that changes and modifications may be made without departing from the spirit and scope of the invention in its broadest aspects and the following claims are intended to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. An intraocular lens assembly for implantation into the posterior chamber of a human eye in operative engagement with a circumferentially extending ciliary muscle of said eye comprising a central lens supported by a ring structure, said ring structure including a compressively deformable outer ring member having a web member extending radially inwardly of said outer ring member, said web member being connected at its distal end to said central lens, said outer ring member being adapted to apply a circumferentially continuous force to said central lens via said web member when said muscle is in a relaxed condition to stretch said central lens radially outwardly after implantation, said outer ring member being further adapted to operatively and abuttingly engage said circumferentially extending muscle after implantation so that said outer ring is compressed by said muscle upon contraction of the muscle to relax said force applied by said outer ring member to said central lens via said web member to enable said central lens to essentially uniformly deform about its circumference and alter its curvature.

2. The intraocular lens assembly of claim 1 wherein said central lens deforms by a radial increment of at lest